Box 6–2 Wildlife as Disease Delivery Systems

"Bacteriological warfare is science stood on its head…a gross perversion." -from an official paper published by the Soviet Union in 1951[26]

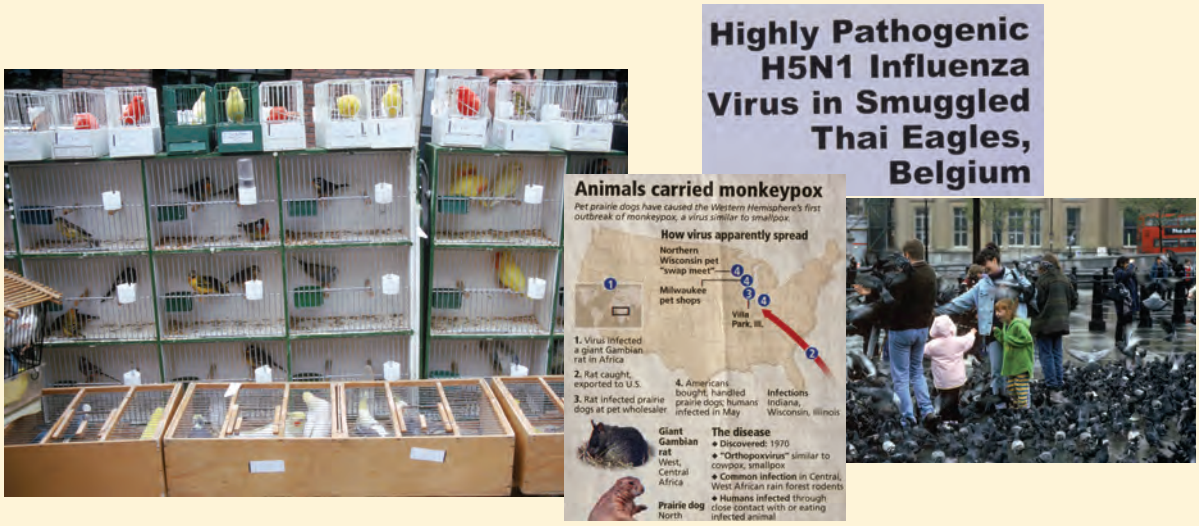
In the past, wildlife have been used as delivery systems for biological warfare, where these free-ranging animals were captured, infected, and released back into the wild to transmit disease to others of their kind, as well as to other susceptible species. Terrorists could use diseased wildlife to convey pathogens to wildlife and other species.

During the 19th, and into the 20th century, Montana Livestock Sanitary Board (USA) veterinarians used mange mites (*Sarcoptes scabiei*) as a means for reducing coyote and wolf numbers to protect livestock from depredation. Healthy coyotes and wolves were trapped, infested with mange mites, and released in attempts to initiate mange epizootics.[149,150] Similar practices targeting dingoes (**wild dogs**) took place in Australia.[151]

Although mange has long been recognized as a human pathogen, the mange mites infesting coyotes and wolves posed little human health risk because the mites were host-specific (to **canids**).[152,153] The situation differed for ranchers who attempted to employ tularemia (*Francisella tularensis*) as a biological weapon.

Tularemia is a category A disease (highest priority) within the current ranking of critical biological agents for public health response (Table 6.3). Ranchers in California (USA) considered any human disease risks for this disease as acceptable, as long as they could achieve their objective of reducing small rodent populations. These ranchers believed the small rodents were competing with livestock for forage on range and grasslands. So they employed **ground squirrels** infected with tularemia as vehicles to help decimate the rodent populations.[154,155] Other notable examples of wildlife being used as vehicles to initiate infectious disease epizootics in free-ranging wildlife populations include myxomatosis and viral hemorrhagic disease of rabbits (Table A).

Certain infectious diseases used for biological control can combat unwanted vertebrate species but are seldom employed because of low success rates and inherent risks to those releasing the agents.[156–158] Today, there is the capability to develop genetically modified disease agents that may target just a single species, thus reducing the potential for unwanted effects. Yet, these capabilities can go astray. Recently, a killer mousepox virus (highly virulent strain) emerged from a laboratory that genetically engineered the virulent strain to be a vector-borne contraceptive for reducing rodent populations. This unexpected killer virus outcome caused alarm because of the potential for similar outcomes in viruses that infect humans. This potential has implications for the development of new biological weapons.[54,159]



Photos by Milton Friend

The frequent movement of pathogens through the illegal and legal transportation of wildlife attests to the need for concern regarding wildlife as potential vehicles for bioterrorism.

Table A. Examples of infectious disease used for biological control of vertebrates.

Disease	Agent	Type	Targeted species	Country	Comments
Sarcocystis	*Sarcocystis singaporensis*	Protozoan parasite	Wild rats 	Thailand	Mortality of 58–92%.[156,160]
Capillariasis	*Capillaria hepatica*	Nematode (roundworm) parasite	House mouse 	Australia	Results unclear.[161]
Feline panleucopaenia	Parvovirus	Virus	Feral cats 	Oceanic Islands	Estimated populations of 3,400 cats on sub-Antarctic Marion Island reduced to about 620[156,162,163] successful in reducing cat populations in most cases.[156,164]
Myxomatosis	Myxoma virus	Virus	European rabbit 	France	Deliberate 1952 introduction on an estate resulted in unintentional spread leading to death of 90–98% of French rabbit population and spread of disease to other countries in Europe.[156,165]
Myxomatosis	Myxoma virus	Virus	European rabbit 	Australia	Initial reductions greater than 95% of populations; classic example of biological control by a pathogen.[156,165–167]
Rabbit hemorrhagic disease	Calicivirus	Virus	European rabbit 	Australia	Escaped from experimental biological control studies on an island in 1995 and invaded mainland; spread at rates of up to 414 km/month with initial mortality reaching 95% in some areas.[156,168–170]
Rabbit hemorrhagic disease	Calicivirus	Virus	European rabbit 	New Zealand	Illegal, intentional 1997 introduction resulted in high mortality and rapid spread among rabbit population.[156,171,172]
Mange	*Sarcoptes scabiei*	Metazoan parasite	Coyote 	USA	Anecdotal reports of infected coyotes being released to initiate epizootics causing reductions in coyote populations early in the 20th century.[150]
Tularemia	*Francisella tularensis*	Bacteria	Ground squirrels 	USA	Anecdotal reports of infected ground squirrels being released to initiate epizootics to help reduce small rodent populations during the early 1900s.